

Australian Scorpionidea by L. Glauert, F.G.S.

PART I.

(Read November 11, 1924. Published July 20, 1925.)

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INTRODUCTION.

The earliest records of Australian Scorpions are to be found in the works of C. L. Koch (1837-1850), Thorell (1876-1877), and Count Keyserling (1884-1889), where a few odd species are described. Numerous additions to the fauna were made by Mr. R. I. Pocock in a number of papers, which appeared in the *Annals and Magazine of Natural History* from 1888 to 1902.

In 1899 Prof. K. Kraepelin brought together all the available information in Part 8 of *Das Tierreich, Scorpiones und Pedipalpi*, a work of the greatest importance, which has been taken as the basis of the present paper. The classification there proposed has been adopted, and the keys provided have been widely drawn upon in the following pages. Kraepelin here recognised six genera (*Isometroides*, *Archisometr*, *Isometr*, *Urodacus*, *Hormurus*, and *Cercophonius*), nineteen valid species, and one doubtful species.

To this list, Pocock's paper of 1902 (A.M.N.H. (7) VIII.), added three species, *Urodacus spinatus*, *U. simplex*, and *U. subarmatus*. The results of Kraepelin's examination of the collection made in South-Western Australia by Drs. Michaelsen and Hartmeyer, were published in 1908, and increased the known species by four: *Urodacus hartmeveri*, *Cercophonius michaelseni*, *C. granulatus*, and *C. sulcatus*. In 1911 Mr. A. S. Hirst described a remarkable *Lychas* from Central Australia, which he made the type of a new subgenus, *Lychas (Hemilychas) alexandrinus*. This new form bears a striking superficial resemblance to the rare *Isometroides*, a genus widely distributed in Australia, but not often seen in collections.

Sarasin and Roux, in their work, "Nova Caledonia," include in Zoology Volume I. (1914) a contribution by Kraepelin on the Scorpions and Pedialpi, in which is to be found a detailed description of the genus *Hormurus*. This description and Dr. Kopstein's results in the paper "Die Skorpione des Indo-Australischen Archipels . . ." published in the *Zoologische Mededeelingen of the Rijks Museum, Leyden* (1921), have been of the greatest assistance to me when dealing with the specimens of *Hormurus* in the collections before me.

Kraepelin's paper on the Scorpions collected in Australia, 1910-1913, by Dr. E. Mjoberg, appeared in 1916. The collection contained 44 specimens belonging to 14 species, four of them new, *Lychas mjobergi*, *L. spinatus*, *Urodacus fossor*, and *U. granifrons* (not of Pocock, 1898). The present paper is submitted as a contribution to our knowledge of the Scorpions of Australia. It is the result of a careful examination of the specimens in the Western Australian Museum, and of collections kindly forwarded to me for study from all parts of Australia. This extensive material contained examples of practically all the recorded species, and included a number of specimens new to science. The various species have been described according to a uniform plan, and keys inserted for the rapid determination of the families, genera, and species known to occur in Australia and Tasmania. The synonymy is mainly restricted to publications which appeared subsequent to Professor Kraepelin's Monograph of 1899.

The Directors of the Australian Museum, Sydney; the National Museum, Melbourne; the Queensland Museum, Brisbane; and the Tasmanian Museum, Hobart; the Curator of the Macleay Museum, University of Sydney, and Professor F. Wood Jones, of Adelaide, generously placed in my hands the Australian specimens contained in their collections.

Professor W. Michaelsen, of the Natural History Museum, Hamburg, and Dr. F. Kopstein, of Ambon, Dutch East Indies, by forwarding literature not available here, have enabled me to solve several problems of distribution.

To all these kind friends I acknowledge my indebtedness and express my thanks.

DEFINITION OF TERMS.

On account of the confusion in the nomenclature of parts of systematic importance, it is advisable to explain the terms used in the present paper. The *body* of the Scorpion is considered to consist of two parts, the *trunk* and the *tail*. The *trunk* bears on its anterior upper surface a chitinous plate, the *carapace*. Near the middle of this *carapace* are two *median eyes*, usually placed upon a

raised *ocular tubercle*, and close to the antero-lateral angles are a group of smaller *lateral eyes*, which, in Australian species, number from two to three in each group. The area between the median eyes and the two groups of lateral eyes is known as the *inter-ocular triangle*. In some forms the carapace bears several more or less longitudinal *keels*; they are the *anterior median keels* in front of the ocular tubercle; the *central median keels*, just behind the ocular tubercle; and the *posterior median keels*, near the posterior border of the carapace.

The *front* may be divided into two *frontal lobes* by a more or less pronounced emargination, the *median notch* or *frontal notch*, and a groove, the *median sulcus*, may extend from the frontal notch to the posterior border, often widening behind to form a *triangular depression*. On the ventral surface behind the basal (coxal) joints of the second pair of legs, and in front of the *genital operculum*, is the *sternum*, the shape and size of which are of great importance. The rest of the trunk is the *abdomen*; it is covered dorsally by seven plates, the *tergites*; these may be smooth or may bear one or more keels, a *median keel* and *lateral keels*; the tergites are connected by soft elastic chitin with their corresponding ventral plates, the *sternites*. The first sternite bears the *genital opening* covered by the *genital operculum*; the second carries the comb-like organs or *pectines* in whose structure four portions are distinguishable, the *anterior lamellae*, the *middle lamellae*, the *teeth*, and, in some genera, the *fulcra*, a series of small pieces placed between the basis of the movable teeth.

The third, fourth, fifth and sixth sternites, referred to as the first, second, third and fourth in this paper, bear the *stomata*, or paired openings leading to the lung-books; the last segment (really the first segment of the metasoma) is without stomata, but often carries more or less well-marked *median* and *lateral keels*.

The *tail* consists of five *segments* enclosed in complete hard chitinous rings, and a *postanal segment* bearing the sting. The upper surface of the first four segments usually bears a *sulcus* flanked by the *superior keels*; on the ventral surface is the *inferior keel*, which may be single or duplicated owing to the presence of a *median sulcus*; the lateral surface usually carries a *supero-lateral* and an *infero-lateral keel*, and may be more or less completely subdivided by the development of an *accessory lateral keel*. The *fifth caudal segment* may agree with the rest in the disposition of its keels, or may differ greatly; its ventral surface is without a sulcus, and usually bears a single median *inferior keel*, which may become forked posteriorly; this segment bears the anus. The *post-anal segment* is more or less globular at its base, forming a *vesicle*, and terminates in a fine curved point, the *aculeus*; the presence or absence of a *tooth* under the *aculeus* is of systematic importance.

The *appendages* comprise a pair of *chelicerae* or *mandibles*, a

pair of *pedipalpi*, and four pairs of walking *legs*. The three-jointed *chelicerae* have the first joint small, the second strongly developed, and bearing internally at its distal end a projection which forms the *immovable* or *fixed finger*; the third joint, or *movable finger*, is external and both fingers are armed with *teeth* one or more rows. The *pedipalpi* consist of six joints, the *coxa*, *trochanter*, *humerus*, *brachium*, the *hand* with the internal *immovable* or *fixed finger*, and the terminal joint, the external *movable finger*. The keels on the *humerus* and the keels and pores on the *brachium* are often of systematic value. In some forms the upper surface of the *hand* is uniformly rounded, whilst in others a *finger keel* divides it into two flattish surfaces, the inner of which may be subdivided by an *accessory keel*; *inner* and *outer keels* are also often present, separating the upper from the lower surface; keels may also be developed on the lower surface of the hand. The biting edges of the fingers are furnished with one or more rows of minute *teeth*, arranged characteristically in the different genera. The *ambulatory legs* are seven-jointed, the joints being known as the *coxa*, the *trochanter*, the *femur*, the *patella*, the *tibia*, the *protarsus*, and the *tarsus*. Of these, the three terminal joints furnish highly important characteristics; the *tibia* may bear a *tibial spur* at its lower distal extremity, and from the soft membrane between the *protarsus* and *tarsus* may issue one or more *pedal spurs*. The *protarsus* may bear *dorsal spines*, and the *tarsus* be variously furnished on its lower surface with *hairs*, *bristles*, *spurs* and *teeth*; this joint usually bears a pair of *movable claws* at its distal extremity, and may project in a *claw lobe* over the base of these; it sometimes also carries *lateral lobes*, which may or may not be toothed.

In addition to its armature of setae, spines, teeth granules, and keels, the surface of the body and limbs may bear fine *punctures*, coarse *setiferous pores*, as well as the more highly specialised sense organs, the trichobothria or "auditory hairs" of Kraepelin; these last are circular and crater shaped; they are surrounded by a raised ring, usually paler in colour, and from each of them issues an extremely fine hair, the diameter of which is from one-fifth to one-fourth of that of the aperture at the base of the depression. These sense organs are usually present on some of the joints of the *pedipalpi*.

The *measurements* given throughout the paper are in millimetres.

The *Sexual Characters*.—As a rule the males can be distinguished by their smaller trunk, more pronounced granulation on the carapace and tergites, greater development of the keels on the hand, longer pectines and more numerous pectinal teeth. The genital operculum of the male is always divided.

Further particulars are to be found in the descriptions of families and genera in the following pages.

SYSTEMATIC DESCRIPTION OF THE AUSTRALIAN SCORPIONS.

The Scorpions known to occur in Australia belong to the families *Buthidae*, *Scorpionidae*, and *Bothriuridae*. Of these the first two are widely distributed, whilst the third is confined to Southern South America and Australia south of the 27th parallel.

KEY TO THE AUSTRALIAN FAMILIES.

- A. Sternum represented by two small transverse plates, at times hardly visible; middle lamellae moniliform; feet with two pedal spurs. Size, small, less than 45 mm. *Bothriuridae*
- B. Sternum at least half as long as broad, often longer than broad, middle lamellae never moniliform.
 - A1. Sternum small, triangular or (rarely) pentagonal, feet with two pedal spurs; tibial spur present on the third and fourth legs in some genera; tooth often present under the aculeus. Hands rounded, fingers long. Size small, less than 45 mm. *Buthidae**
 - B1. Sternum large, markedly pentagonal; feet with one pedal spur; no tibial spurs; no tooth under the aculeus. Hands generally keeled. Size medium or large, up to 120 mm. *Scorpionidae*

Family BUTHIDAE.

Buthidae, E. Simon, 1879, *Arach*, France. VII.—p. 92.

Sternum small, triangular, truncated anteriorly or sub-pentagonal. Legs with inner and outer pedal spurs, the outer sometimes duplicated. Tibial spurs may be present on the third and fourth legs; lateral lobes absent. Hands rounded, with or without keels, fingers long. A tooth present under the aculeus in some genera.

Sexual Characters: The male with the tail and pedipalpi usually longer and thinner or much thicker and scarcely longer; pectines longer. Genital operculum divided in both sexes.

Key to the Sub-Families.

- A. Tibial spur *present* on the third and fourth legs. . . *Buthinae*
- B. Tibial spur *absent* on the third and fourth legs . . *Centrurinae*

Sub-Family **Buthinae.**

Buthinae, K. Kraepelin, 1899, *Das Tierreich* Lief 8. Scorpiones und Pedipalpi, p. 6.

Tibial spur present on the third and fourth legs. The immovable finger on the chelicerae below, with two, one or no teeth.

* In some of the *Buthidae* the male attains a length of 70 mm. owing to the great development of the tail.

Key to the Genera.

- A. Tooth under the aculeus strong, triangular, pointed or small. *Lychas*
 B. No tooth under the aculeus, vesicle long and slender, merging gradually into the curved aculeus *Isometroides*

Genus **Lychas**. C. L. Koch, 1850.

Lychas. C. L. Koch, 1850. Uebers. des Arachnidensystems. V., p. 92.

Archisometrus Kraepelin 1891. Mitt. Mus. Hamb. VIII, p. 75.

Archisometrus Kraepelin 1899. Das Tierreich Lief 8, p. 41 (and synonymy).

Lychas Kraepelin. 1908. Fauna Suedwest Australiens II. Lief 7, p. 87.

Lychas Kraepelin. 1916. Ark. Zool. K. Svensk Vetensk. Ak. X, No. 2, p. 22.

A tooth on the lower edge of the immovable finger of the chelicerae. Tibial spurs on the third and fourth legs. Tooth under the aculeus. Tergites with median keel, rarely with indications of lateral keels. Carapace keelless or with keels weakly developed; front horizontal, slightly emarginate. Sternum longer than broad, triangular. Fingers of the pedipalpi with few, non-overlapping inclined series of teeth, each series flanked internally and externally by a single enlarged lateral tooth*. Caudal segments (except in *Hemilychas*), all keeled.

Key to the Sub-Genera.

- A. Fifth caudal segment normally keeled *Lychas*
 B. Fifth caudal segment smooth and shining, punctured keelless *Hemilychas*

Subgenus **Lychas**.*Key to the Species.*

- A. Tergites with indications of lateral keels.
 A.1 Third caudal segment with 10 keels, pectines with 11-12 teeth *L. bituberculatus* (Poc.)
 B.1 Third caudal segment with 8 keels, pectines with 20-21 teeth *L. jonesae* n. sp.
 B. Tergites without indications of lateral keels.
 C.1 Tooth under the aculeus minute, pectines with 22 teeth *L. mjobergi* Kr.

* The basal series of teeth, in certain species, has two enlarged external lateral teeth. See below.

D.1 Tooth under the aculeus of medium size, truncated, wider than high, no dorsal tubercle.

A.2 Variegated, markings as in *L. marmoreus*, general colour above ochraceous orange with fifth caudal segment darker. Vesicle longer, almost parallel sided, dull keeled *L. annulatus* n. sp.

B.2 Colour uniform tawny, fourth caudal segment darker. Vesicle shorter, swollen, shining, keelless *L. truncatus* GL

E.1 Tooth under the aculeus large, much higher than wide, usually with dorsal tubercle.

C.2 Third caudal segment with 10 keels.

A.3 Terminal tooth of superior caudal keels not enlarged, or but slightly so. Basal series of teeth on movable finger of hand with 1 enlarged external lateral tooth *L. marmoreus* (Koch)

B.3 Terminal tooth of superior keels enlarged, erect. Basal series of teeth on movable finger of hand with 2 enlarged external lateral teeth *L. spinatus* Kr.

D.2 Third caudal segment with 8 keels.

C.3 Terminal tooth of superior keels of first three caudal segments much enlarged, erect. Fingers on hand of male lobed. Trunk, uniform brownish. Pectines with 19-23 teeth *L. armatus* (Poc)

D.3 Terminal tooth of superior keels of first three caudal segments hardly enlarged. Fingers on hand of male not lobed. Trunk variegated. Pectines with 10-17 teeth *L. papuanus* (Thor)

Lychas marmoreus (C. L. Koch) 1845.

Tityus marmoreus C. L. Koch 1845. Arachnida II, p. 36.

Isometrus variatus Thorell 1877. Atti. Soc. Ital. XIX, p. 136.

Isometrus thorelli Keyserling, 1885. Arachn. Austr. II, p. 12, pl. 2, fig. 1.

Archisometrus marmoreus Kraepelin, 1899, Das Tierreich, Lief 8, p. 49 (and synonymy).

Lychas marmoreus Kraepelin, 1908, Fauna Sudwest-Austr. II, Lief 7, Scorpiones, p. 87.

Lychas marmoreus Kraepelin, 1916. Ark. Zool. K. Svensk. Vetensk. Ak. X, No. 2, p. 26, figs. 3a, b, c.

Colour, rather variable, general colour brownish; ground

colour yellowish more or less obscured by brown or blackish markings which may give the abdomen a checkered appearance or resolve themselves into irregular blotches or marblings; tail usually paler than the trunk, marbled blotched, or with the keels only pigmented with brownish; fifth segment and vesicle often dark brown with or without rows of pale ocelli on the intercarinal spaces. Pedipalpi and legs paler yellow, marbled, blotched or banded with dark brown; hand pale yellow, often with a few dark longitudinal bands or irregular markings; fingers dark brown basally, yellowish towards the tip. Under surface variable, pale yellow, yellow dusted with darker, or yellowish with dark blotches and marblings. The darker areas on the carapace and tergites are usually more coarsely granular, the lighter areas being often finely granular or even smooth.

Carapace coarsely granular, the larger granules behind the ocular tubercle forming a pair of indistinct median keels, posterior median keels more pronounced, granular, superciliary crest coarsely granular, short, its length less than three times the horizontal diameter of the eye: median sulcus with fine granules, smooth when crossing the ocular tubercle. *Tergites* dull, coarsely granular with subdenticulate median keel and no indications of lateral keels, last with five granular keels, the median weak, abbreviated posteriorly, lateral keels regularly granular, the submarginal terminal granule of the inner pair not enlarged, outer pair shorter, not reaching the posterior margin of the tergite; the inner pair often persist to the anterior margin. *Sternites* variable, the third and fourth may be finely granular laterally, fifth granular throughout with four subdenticulate keels. *Tail* moderate, first three segments with ten keels, the accessory keel often weak on the third, but persisting to the posterior margin, fourth segment with eight keels, the accessory keel sometimes represented by a longer or shorter row of coarse granules, the terminal granule of the upper keels somewhat enlarged particularly in the male, inferior keels regularly granular. Intercarinal spaces dull, finely granular below the granules, coarser above. Fifth segment with five granular keels, intercarinal spaces with finer and coarser granules, the larger roughly aligned inferiorly, absent on the convex upper surface which is closely covered with fine granules. *Vesicle* rather shining, with indistinctly granular ventral and lateral keels, intercarinal spaces with scattered granules, sulci smooth. *Aculeus* fairly long and curved. Tooth under the aculeus strong, slightly compressed laterally, obtusely pointed, with or without a dorsal tubercle. *Pedipalpi*-Humerus with granular keels and granular intercarinal spaces, the granules larger above. Brachium with granular keels above, intercarinal spaces finely granular, lower surface very finely granular, anterior surface with an arched crest bearing several strong distally directed teeth.

Hand rounded, smooth, with indistinct finger keel, fingers long and curved, the basal series of teeth on the movable finger with one enlarged external lateral tooth. *Legs* granular with granular keels. *Pectines* with from 13 to 21 teeth, the females have shorter and less numerous teeth than the males. *Dimensions*, length up to 35. (Trunk to tail as 1 to 1½.)

Distribution: New Guinea and practically the whole of Australia.

Remarks: Professor Kraepelin has distinguished a number of varieties, one of which *L. m. marmoreus* has a range extending from New Guinea through Queensland, New South Wales, Victoria, and South Australia to South Western Australia as far north as the vicinity of Moora and Boorabbin, the others are much more restricted in their distribution. The material before me, whilst enabling me to extend the range of some of the forms, allows me to confirm the conclusions arrived at by Professor Kraepelin in his valuable paper of 1916. His key is translated and reproduced below.

Key to the Varieties.

- A. Sternites dull, with a small subtriangular shining area near the posterior border of the third sternite. Each tergite usually with three pale yellow markings posteriorly between the median keel and the pale lateral margin. Sternites usually more or less pigmented with darker. Pectines with 13-17 teeth.
- A.1 Pectines and coxae pale (rarely indistinct darker markings on the coxae). Tooth under the aculeus with dorsal tubercle. Anterior sternites often but faintly pigmented *L. marmoreus marmoreus* Koch.
- B.1 Pectines and Coxae strongly marked with darker or blackish. Tooth under the aculeus conical with or without dorsal tubercle. All the sternites strongly pigmented, median paler area often small *L. marmoreus obscurus* Kr.
- B. Sternites all more or less shining, the shining area not confined to the posterior margin of the third sternite. Tergites often with two pale yellow marks posteriorly between the median keel and the pale lateral margin.
- C.1 Pectines and coxae with dark markings. Sternites all strongly suffused and marked with darker. Tergites with three pale yellow markings posteriorly between the median keel and the pale lateral margin
 *L. marmoreus nigrescens* Kr.

D.1 Pectines and coxae uniformly pale yellow. Sternites pale yellow but the posterior ones at times somewhat pigmented or suffused with darker. Tergites with two pale yellow markings posteriorly between the median keel and the pale lateral margin.

A.2 Tooth under the aculeus with dorsal tubercle, Carapace with two distinct granular posterior median keels. Fingers usually not differing much from the hand in colour. Vesicle often uniformly brown or yellowish.

A.3 Pectines with 17-21 teeth. Vesicle swollen, egg-shaped, its median keel passing evenly into the lower edge of the tubercle. Median keel of the tergites yellowish anteriorly, dark posteriorly on each segment. Fifth caudal segment with yellow ocelli .. *L. marmoreus variatus* (Thor.)

B.3 Pectines with 13-14 teeth. Vesicle more or less cylindrical, its median keel not passing evenly into the lower edge of the tubercle but forming a distinct angle. Median tergal keel often, but not always, entirely blackish. Vesicle usually uniformly reddish brown
.. .. . *L. marmoreus kimberleyanus* Kr.

B.2 Tooth under the aculeus conical, without dorsal tubercle. Carapace without distinct posterior median keels. Fingers more or less blackish, sharply defined from the pale yellow hand. Vesicle brown, laterally with two rows of large pale yellow ocelli, almost cylindrical, its inferior median keel not passing gradually into the tooth under the aculeus, but forming a distinct angle. Pectines with 14-16 teeth
.. .. . *L. marmoreus splendens* Kr.

L. marmoreus marmoreus occurs in New Guinea, Queensland, New South Wales, Victoria, South Australia and South Western Australia as far north as Moora and Boorabbin.

L. marmoreus variatus is found in Western Australia and North Western Australia.

L. marmoreus splendens is known from the vicinity of Geraldton, Moora, Tammin, Balladonia, Sandstone, and Euro in Western Australia, also from Greenly Island and Black Rock Island, South Australia.

L. marmoreus kimberleyanus occurs in the Kimberley District, North Western Australia.

L. marmoreus obscurus is a Victorian form known from the Grampian Ranges, Abbotsford and Ararat.

L. marmoreus nigrescens, confined to New South Wales, is recorded from Sydney and St. Peters, Penrith.

***Lychas papuanus* (Thor.) 1888.**

Isometrus variatus var. *papuanus*. Thorell, 1888. Ann. Mus. Genova XXVI, p. 407.

Archisometrus marmoreus. Kraepelin, 1899. Das Tierreich, Lief 8, p. 49.

Lychas papuanus. Kraepelin, 1916, Ark. Zool. K. Svensk. Vetensk. Ak. X, No. 2, p. 29, fig. 4.

Colour variable, the ground colour of the trunk ranges from a pale yellow to ochraceous tawny or even darker and the markings from brown to blackish, the colour pattern much as in *L. marmoreus*, frontal lobes pale yellow, three pale yellow subrectangular markings near the posterior border of the first six tergites on each side of the median keel, and exclusive of the lateral marginal patch. Third and fourth caudal segments usually rather darker posteriorly, fifth segment considerably darker with yellowish terminal bands proximally and distally; vesicle resembling the fifth segment. Sternites yellowish with brownish markings, coxae and pectines also occasionally pigmented. Pedipalpi blotched, spotted or marbled with darker, hand yellowish with darker markings defining the keels and encroaching upon the intercarinal spaces, fingers yellowish, darker basally, the base at times almost blackish; legs blotched and marbled with darker, the dark markings often running together and enclosing circular or sub-circular yellow areas.

Carapace dull, closely granular, the keels absent or weakly developed, superciliary crest granular, distinct, median sulcus granular except when crossing the ocular tubercle. Tergites dull, granular, with a row of larger granules along the posterior margin of the tergite; median keel on the first segment obsolete more strongly developed on the posterior segments, sub-denticulate, no traces of the lateral keels, last tergite with five keels, the median weak, posteriorly abbreviated, the lateral keels with the granules increasing in size posteriorly, the sub-marginal terminal tooth on the median pair not at all or slightly enlarged. Sternites dull, with a smooth shining area at the posterior margin of some of the segments, third segment with a few granules at the posterolateral angle, fourth more granular laterally with indications of granular median keels, fifth segment finely granular throughout with four sub-denticulate keels, the inner pair being the longer but not reaching the anterior margin. Tail short, first segment with ten keels; second segment with ten keels, the accessory keels being extremely weak; third and fourth segments with eight keels,

the lateral keel on the third segment being represented by a longer or shorter row of irregularly spaced granules; intercarinal spaces dull, more or less finely granular, the granules larger above, all four segments with the terminal tooth of the superior keels enlarged, more so in the males. Fifth segment with five granular keels and dull granular intercarinal spaces, the larger granules on the under surface roughly aligned, irregularly scattered on the lateral surfaces, absent on the dorsal surface which is convex, has a shallow smooth median sulcus with the lateral areas closely covered with fine granules. *Vesicle* egg-shaped, with obsolescent granulation on the keels and scattered granules on the intercarinal spaces. *Aculeus* strong and curved, about three-fourths the length of the vesicle; tooth under the aculeus long, strong, somewhat compressed laterally with small dorsal tubercle. The basal diameter of the tooth is equal to that of the aculeus and to the width of the intervening space. *Pedipalpi*, Humerus and Brachium normal, Hand rounded, not wider than the brachium, keelless, smooth, as long as the first two and half of the third caudal segments. Fingers long and slender, the basal series of teeth on the movable finger with one or occasionally two external lateral teeth. *Legs* normal, keeled and finely granular. *Pectines*, in the male with 14-17 teeth, in the female with 10-16 teeth. *Dimensions*, up to 40, trunk 16, tail 24; several specimens measured 36, trunk 15, tail 21.

Distribution: New Guinea, Queensland and New South Wales (Bankstown and Brawlin). The *Type* from Cape York Peninsula is in the Museo Civico, Genoa.

Remarks: Specimens from Bankstown and Brawlin in the collection of the Australian Museum extend the range of this species into New South Wales, where its presence was unrecorded.

***Lychas armatus* (Pocock) 1890.**

Isometrus armatus. Pocock, 1890, Journ. Linn. Soc. XXIII, p. 439, pl. 11, figs. 3-3d.

Archisometrus armatus. Kraepelin, 1899. Das Tierreich, Lief 8, p. 47.

Male.

Colour, general colour from dresden brown to raw umber, trunk yellowish with darker markings as in *L. marmoreus*, but less heavily pigmented, ocular tubercle blackish, tail almost devoid of markings. the distal segments and vesicle walnut brown to sayal brown, under surface, coxae and pectines paler; legs and Pedipalpi marked with darker, fingers uniform yellowish brown.

Carapace emarginate in front, dull, thickly covered with lar-

ger and smaller granules; median sulcus almost smooth, deeper behind; ocular tubercle and the surrounding area almost smooth. Posterior median keels represented by a longer or shorter row of granules. *Tergites* dull, thickly and coarsely granular particularly near their posterior margin, first tergite with faint sub-granular median keel posteriorly, the second to the sixth with a conspicuous granular median keel, seventh with an obsolescent sub-granular median keel anteriorly and two granular keels on each side, the outer reaching the posterior margin, the inner terminating behind in a sub-marginal enlarged tooth or granule. *Sternites* first three smooth and rather shining, fourth weakly and finely granular laterally, with or without indications posteriorly, of two short smooth median keels, fifth sternite weakly granular throughout, with four subdenticulate keels which do not reach the anterior margin. *Tail* moderately strong not elongated, almost parallel sided; first two segments with ten granular keels; third and fourth with eight granular keels; all the inferior, infero-lateral and accessory keels regularly and evenly granular, the supero-lateral and superior keels of the first segment more strongly developed behind than in front, terminal tooth not enlarged; supero-lateral and superior keels of second segment with enlarged terminal tooth, the superior being more prominent and sub-erect, the accessory keel on this segment weak, terminal tooth of superior keel of third segment developed into a enormously long and strong sub-erect tooth, that of the supero-lateral keel not much enlarged, accessory lateral keel on this segment represented by a row of granules anteriorly; superior keel of the fourth segment with long and strong sub-erect terminal tooth, smaller than that on the third, terminal tooth of supero-lateral keel scarcely enlarged. Intercarinal spaces weakly granular, the granules more abundant on the third segment. Fifth segment with five keels, superior keels very weakly granular, a few larger granules posteriorly, infero-lateral keels finely and evenly granular, inferior keel coarsely granular, the granules larger behind; upper surface convex with a shallow median sulcus, finely granular, lateral surface flat, finely granular, the granules more numerous near the upper margin; under surface very convex, coarsely and finely granular, the coarser granules roughly aligned on each side of the ventral keel. *Vesicle* slender, the keels on the under surface rather coarsely granular, the granules on the upper keels finer. *Aculeus* long and curved, tooth under the aculeus strong, laterally compressed with distinct dorsal tubercle. *Pedipalpi*: Humerus above with the keels granular and well developed, intercarinal spaces feebly granular, posterior surface with weakly granular keel; anterior surface with several large granules and a finely granular keel below. Brachium with three strong granular keels above, the granules coarsest on the anterior of these; anterior surface with a few large and sharp teeth, their tips directed distally, lower surface sub-costate and

weakly granular. Hand rounded and swollen, not narrower than the brachium, with a sub-granular finger keel which becomes smooth on the finger, upper surface feebly granular; fingers "long and slender, curved, sub-costate, immovable finger at the base bearing a distinct lobe, on the distal side of which is a distinct sinuation, the opposite (external superior) surface being convex to correspond with the sinuation; the movable digit sinuate and lobate to correspond with the lobe and sinuation of the immovable digit"; fingers with teeth in normal number of series, the basal having one or two external lateral teeth. *Legs* strongly granular and keeled. *Pectines* with 19-23 teeth. *Dimensions*: Total length up to 47, trunk 18, tail 29. The dimensions given by Pocock are: total length 43, trunk 15, tail 28, first segment of tail 3, width 3.5; second segment 4, width 3; third segment 4.3, fourth segment 5, fifth segment length 7, width 3; vesicle length, 3.5, width 2, height 2. Humerus 5, Brachium, 5.5 width 2; Hand width 2.5, length of hand back 3.5, length of movable finger 5.7.

Female similar to the male but less granular and with the terminal teeth on the second, third and fourth caudal segments less prominent; the hand less swollen and the fingers not lobed at the base; pectines shorter though with the same number of teeth.

Distribution: Northern Territory, Port Essington and Port Darwin. The *Type* is in the British Museum; it was collected at Port Essington.

Remarks: A specimen from the type locality, one of the two specimens before me, has two teeth external to the basal series, the other has one external tooth on the movable finger.

***Lychas spinatus* Kraepelin 1916.**

Lychas spinatus. Kraepelin 1916, Ark. Zool. K. Svensk. Vetensk. Ak. X, No. 2, p. 32, fig. 5.

Female.

Colour, ground colour pale yellow marked with blackish as in *L. marmoratus*, Tergites with three pale subrectangular markings posteriorly on each side of the median keel (excluding the marginal patch). Tail yellow with dark markings, fifth segment and vesicle darker. Pedipalpi marked with blackish, hand with blackish longitudinal markings, fingers yellow, slightly darker basally. Sternites slightly pigmented laterally with indications of a median stripe, last sternite heavily pigmented. Pectines and coxae pale yellow. Legs mottled.

Carapace coarsely granular, posterior median keels indistinct. *Tergites* coarsely granular, with granular median keel, no traces

of lateral keels. *Sternites* rather dull but area surrounding the stigmata and the posterior margin of the second, third and fourth sternite smooth and shining; fourth sternite granular laterally with two smooth shining median keels; fifth sternite granular throughout, with four granular keels, the median pair reaching the posterior margin. *Tail* robust; superior keels of segments 1-4 with enlarged short, stout, sub-erect terminal tooth, presumably more developed in the male. Accessory keel represented on the third segment by a persisting row of granules, indicated on the fourth segment; intercarinal spaces distinctly granular, particularly on the posterior segments; under surface of the fifth segment with granules roughly aligned. *Vesicle* egg-shaped, its keels with obsolescent granulation, tooth under the aculeus strong, with dorsal tubercle, its basal diameter equal to the distance between the base of the tooth and the aculeus. Length of the *Aculeus* rather more than half the length of the vesicle (2.2 : 4). *Pedipalpi*: Humerus granular above. Brachium with three granular superior keels. Hand without distinct keels, not wider than the brachium. Fingers with six inclined series of teeth, the basal series with two external enlarged lateral teeth. Relation of width of hand to length of hand and length of movable finger as 2 : 3 : 6. *Pectines*, with 18-20 teeth. *Dimensions*: total length 51, trunk 21, tail 30.

Distribution: Queensland and New South Wales? The *Type* is in the Zoological Museum, Hamburg.

Remarks: The collections before me contain no specimens from Queensland that agree with the above incomplete description. Three individuals in the Australian Museum collection (K.48682) from Bourke, N.S.W., are tentatively identified as belonging to this species.

Key to the sub-species.

- A. Sternites dull, tail longer and robust .. *L. s. spinatus* Kr.
(Q. and N.S.W.)
- B. Sternites shining, tail shorter and slender.
 - A.1 General colour mars-yellow, variegated. Vesicle dull, intercarinal spaces granular *L. s. besti* (Vic.)
 - B.1 Colour uniform cream to tawny. Vesicle shining intercarinal spaces smooth *L. s. pallidus* (N.S.W.)

Lychas spinatus var. *besti* n.s.sp.

Colour: General colour of the trunk mars-yellow with irregular darker markings as in *L. marmoreus*, ocular tubercle and lateral eyes blackish; irregular markings on the carapace, a yellow lateral

band on the tergites and three subrectangular yellow areas on each side of the median keel close to the posterior margin of the six anterior tergites, the median keel pale anteriorly and dark behind; the last tergite yellowish and keels more or less pigmented with darker. Under surface yellowish, the last sternite with scattered darker markings chiefly laterally and posteriorly. Anterior caudal segments yellowish with darker markings on the keels, at times encroaching upon the intercarinal spaces; fifth segment dark brown with a yellow distal band, vesicle dark brown, the sulci paler; aculeus yellow basally, chestnut brown towards the tip. Pedipalpi brownish with circular yellow markings on humerus and brachium, hand yellowish, fingers blackish basally gradually passing to pale yellow at the tip.

Carapace dull, closely granular, keels absent or represented by an indistinct row of granules; superciliary crest coarsely granular, median sulcus with very fine granules. *Tergites* dull, closely granular, the granules rather larger on the darker areas, median keel sub-denticulate, stronger on the posterior segments, no indications of lateral keels; last tergite with five keels, the weak median keel short, not persisting posteriorly; lateral keels with even granulations, the sub-marginal terminal granule not enlarged. *Sternites* smooth and shining, the third and fourth with a few fine granules at the lateral margin, last sternite dull, granular throughout with four sub-denticulate keels not persisting to the anterior margin. *Tail* slender, segments parallel sided, the first three segments with ten keels, accessory keels indicated on the fourth segment. Superior keels of first four segments with enlarged sub-erect terminal tooth, largest on the third; terminal tooth of supero-lateral keels of first three segments slightly enlarged; infero-lateral and inferior keels of first four segments regularly and finely granular, the intercarinal spaces granular, the granules larger above. Fifth segment with five finely granular keels, the intercarinal spaces with coarser and finer granules. *Vesicle* dull, moderately swollen, egg-shaped with obsolete granular keels, smooth sulci and granular in tercarinal spaces. *Aculeus* moderately curved, the tooth large, conical, scarcely compressed, with a very small dorsal tubercle, basal diameter of the tooth greater than its distance from the aculeus. *Pedipalpi* normal, the hand not wider than the brachium, keelless, very finely granular above; fingers about twice as long as the hand, keelless, the basal series of teeth with two enlarged external lateral teeth. *Legs* normal, keeled and finely granular. *Pectines* with from 16-19 teeth. *Dimensions* up to 44.5, trunk 19, tail 25.5; hand as long as the first two and half the third caudal segments.

Distribution: Mallee District of Victoria. The *Type* is in the collection of the National Museum, Melbourne, collected by Mr. D. Best.

Lychas spinatus var. *pallidus* n.s.sp.

Colour: From uniform cream to tawny, immaculate, ocular tubercle and area surrounding the lateral eyes blackish, interocular triangle paler than the rest of the carapace, pedipalpi and fourth caudal segment slightly darker, fifth caudal segment and vesicle distinctly darker, under surface very slightly paler throughout.

Carapace dull, closely covered throughout with larger and smaller granules, superciliary crest coarsely granular, keels obsolescent. *Tergites* dull, closely granular, the granules on each segment increasing in size posteriorly, first segment practically keelless, the rest with sub-denticulate median keel, last segment with median keels weak, abbreviated posteriorly and two pairs of lateral keels, the granules on which increase in size posteriorly; the sub-marginal terminal granule somewhat enlarged. *Sternites* smooth and shining, the first three somewhat rugose laterally, fourth finely granular near the lateral margin, fifth dull, granular throughout, with four sub-denticulate almost smooth keels which end in a pit on the posterior margin but subside before reaching the anterior border. *Tail*, slender, segments almost parallel sided, first three with ten keels, the fourth with eight keels and indications of the accessory keel. The granules on the superior keels increasing in size posteriorly, the keels terminating in a much enlarged tooth which is largest on the third segment. In the females the terminal tooth is directed backwards, in the male it is sub-erect and more developed. Terminal tooth of the superolateral keels on the first three segments also enlarged. Inferolateral and inferior keels on the first four segments regularly and finely granular. Intercarinal spaces dull, finely granular. Fifth segment with five granular keels, the granules being smaller below, intercarinal spaces dull, with numerous coarser and finer granules; superior surface convex, with a shallow median sulcus, finely granular. *Vesicle* smooth and shining, slightly swollen, with sub-granular keels and smooth intercarinal spaces bearing large pores. *Aculeus* moderately curved, short, about half the length of the vesicle. Tooth under the aculeus strong, conical, with small dorsal tubercle; the basal diameter of the tooth about equal to its distance from the aculeus. *Pedipalpi* normal, Hand practically keelless, not wider than the brachium, fingers fully twice as long as the hand, with six series of teeth, the basal series with two enlarged lateral teeth externally. *Legs* keeled, intercarinal spaces finely granular. *Pectines* with 17-21 teeth. *Dimensions*: Total length 44, trunk 20, tail 24; length of hand 6.5, of movable finger, 4.5.

Distribution: New South Wales, probably the interior. The *Types*. The description has been prepared from four specimens, two (K13333) in the Australian Museum, Sydney, and two without

numbers in the collection of the Macleay Museum, University of Sydney. These specimens are accordingly designated co-types.

Lychas truncatus Glauert, 1925.

Lychas truncatus. Glauert, 1925, Trans. Roy. Soc. South Australia, Vol. **LXIX**.

Colour: trunk uniform tawny, ocular areas blackish, limbs and tail yellowish, hand and fingers uniform with no indications of darker markings, fourth segment of the tail and vesicle rather darker; under surface uniform pale yellow.

Carapace dull, covered with coarse granulation, keels granular moderately prominent, superciliary crest well marked, coarsely granular, extending forward for a distance equal to the horizontal diameter of the eye, median sulcus granular, a row of larger granules along the posterior border of the carapace. *Tergites* dull, covered with granules which increase in size towards the posterior border of each segment; median keel sub-denticulate, obsolescent on the first tergite, chiefly developed on the hinder portion of the next five; last tergite with posteriorly abbreviated sub-denticulate median keel and four strongly granular lateral keels, the granules on which increase in size posteriorly, terminal sub-marginal granule not enlarged. *Sternites*, the anterior ones smooth and shining, the last rather dull, with a few very fine granules and four sub-denticulate keels which do not reach the anterior margin, the inner pair persist to the posterior margin. *Tail* first three segments with ten keels, fourth with eight keels, and strong indications of the accessory keels; superior and supero-lateral keels with granules increasing in size posteriorly, terminal granule somewhat enlarged on the first three segments, infero-lateral and inferior keels finely and regularly granular, superior intercarinal spaces shining, with a few coarse granules the other intercarinal spaces dull, with smaller granules; fifth segment with five granular keels, upper intercarinal surface convex, sulcus not pronounced, smooth, with a few large granules, lateral and inferior surfaces shining with larger and smaller granules; *Vesicle* short, swollen, shining, and keelless, the sulci obsolescent, with a number of large pores. *Aculeus* curved, stout, almost as long as the vesicle. Tooth under the aculeus short, strong, conical and truncated, wider than high, without any trace of the dorsal tubercle, the basal diameter of the tooth less than its distance from the base of the aculeus. *Pedipalpi* normal, hand swollen, wider than the brachium, smooth and shining without traces of keels or granulation on its upper surface; fingers long, curved, smooth, with a smooth keel on the fixed finger, the movable finger not more than twice the length of the hand-back. Basal series of teeth with two enlarged external lateral teeth. *Legs* keeled, the intercarinal spaces dull, finely granular. *Pectines* with

22-27 teeth. *Dimensions*: total length 38.5, trunk 14.5, tail 24, length of hand 5.5, less than the first two caudal segments.

Distribution: Victoria, Pyramid Hill, three specimens collected by Rev. E. H. Hennell, Sept. 18, 1890, and South Australia. The *Type* is in the National Museum, Melbourne.

Lychas annulatus n. sp.

Colour: Markings as in *L. marmoreus* but less prominent. General colour above ochraceous orange, the paler markings honey yellow, the darker markings brownish; ocular tubercle and area surrounding the lateral eyes blackish. Tail like the body, fifth segment brownish, with narrow pale proximal band and wider pale distal band. Vesicle honey yellow, Aculeus honey yellow, reddish towards the tip. Pedipalpi and legs like the body, fingers not darker than the hand, under surface uniform yellowish.

Carapace dull, granular, the granules enlarged on the interocular triangle and at the postero-lateral angles. Posterior median keels represented by a row of granules; superciliary crests coarsely granular, terminating abruptly behind the eyes, produced in front, subsiding into an irregular mass of granules half way between the median eyes and the frontal margin. Frontal notch wide and fairly deep; lateral lobes rounded; median sulcus wide, shallow and granular in front of the ocular tubercle, wide deep and smooth posteriorly. *Tergites* dull, coarsely and finely granular, median keel granular, short, abbreviated anteriorly, without traces of lateral keels, last tergite with five granular keels, the median short, not persisting posteriorly, lateral keels regular, granular, serrate, submarginal, terminal tooth not enlarged. *Sternites* shining, rugulose, the fourth finely granular laterally, the fifth finely granular throughout with two long sub-denticulate median keels which do not reach the anterior margin, and two very short sub-denticulate posteriorly abbreviated lateral keels. *Tail* long and stout, first three segments with ten keels, the accessory keel weak on the third segment but persisting to the posterior border, fourth segment with eight keels. Inferior and infero-lateral keels sub-denticulate or finely granular, accessory and supero-lateral keels more coarsely granular, terminal tooth of supero-lateral keel hardly enlarged; superior keels with terminal tooth slightly enlarged. Intercarinal spaces dull, granules very small or absent. Fifth segment with five keels, the inferior keels finely granular, intercarinal spaces with scattered granules. *Vesicle* slightly inflated, dull, with obsolescent granules, keels indistinct, the inferior keel passing gradually into the tooth under the aculeus, sulci scarcely discernible. *Aculeus* as long as the vesicle, moderately curved; tooth under the aculeus stout, short, truncated, wider than high, slightly compressed laterally without dorsal tubercle. *Pedipalpi* normal, hand

slightly swollen not wider than the brachium, keels absent, finger keel indicated by a row of indistinct granules. Fingers long and curved, basal series of teeth on the movable finger with one enlarged external lateral tooth. *Legs* granular, with granular keels. *Pectines* with 25 teeth. *Dimensions*: Total length 39, trunk 15, carapace 4.5, tail 24; length of hand 6.5.

Distribution: Interior of South Australia. The type locality is Kychering Soak, near Tareoola. The *Type* is in the National Museum, Melbourne.

Lychas mjobergi Kraepelin, 1916.

Lychas mjobergi, Kraepelin, 1916. Ark. Zool. K. Svensk. Vetensk. Ak. X, No. 2, p. 24, fig. 2.

Colour: Trunk pale clay yellow with five more or less distinct rows of darker markings, the median marking more or less triangular, the apex being anteriorly. Sternites clay yellow without darker markings. Tail clay yellow with darker markings along some of the superior keels and in the median ventral sulcus; fifth caudal segment darker, with a pale distal terminal ring; vesicle yellow like the anterior caudal segments or rather darker. Pedipalpi and legs uniform clay yellow, a few darker markings on the femur distally and on the tibia proximally.

Carapace granular with granular central and posterior median keels. *Tergites* finely granular with granular median keel. *Sternites*, the first four smooth and shining with coarse punctures, fifth segment smooth with granular median keels and short granular lateral keels. *Tail* short, keels normal and granular, first three segments with ten keels, the accessory keel on the third segment abbreviated anteriorly, fourth segment with eight keels with very faint indications of the lateral keel. Granules on the superior keels of the first three segments increasing in size posteriorly; intercarinal surfaces very finely granular, the granules increasing in size on the posterior segments. Fifth segment with fine granular keels. *Vesicle* globular below, about two thirds as high as long, smooth, with obsolescent keels and rows of pores. *Aculeus* long, curved, about as long as the vesicle. Tooth under the aculeus small reduced to a small granule. *Pedipalpi*, humerus smooth above; brachium normally keeled. Hand not wider than the brachium, smooth, an indistinct granulation on the finger keel. Proportions of the width of the hand to the length of the hand-back and the length of the movable finger as 1.5 to 2 to 3.5. Movable finger with six series of teeth, the basal series with one enlarged external lateral tooth. *Pectines* with 22-22 teeth in the female. *Dimensions*: total length 34.5, trunk 13.5, tail 21.

Distribution: Kimberley District, Western Australia, found un-

der the bark of Eucalypts. The *Type* is in the Royal Zoological Museum, Stockholm.

***Lychas bituberculatus* (Pocock) 1891.**

Isometrus bituberculatus. Pocock, 1891, A.M.N.H. (6) VIII, p. 243.

Archisometrus bituberculatus. Kraepelin, 1899. Das Tierreich, Lief 8, p. 48.

Colour: yellowish with brown markings, pale below; brachium brownish, paler distally, hand yellowish, fingers yellowish, darker towards the tip; tail yellowish like the trunk, fifth segment brownish posteriorly, vesicle darker basally, distal half of the aculeus brownish.

Carapace: coarsely granular throughout, the granules showing a distinct tendency in some parts to constitute definite keels, the posterior median keels well marked, slightly diverging in front, the median eyes large, the tubercle granular at the sides. *Tergites* coarsely granular, the median keel well marked; a tubercle on each side of the median keel on the posterior margin marks the position of the lateral tergal keels characteristic of e.g., *Buthus*; the lateral keels of the seventh tergite subequal in length, with the posterior granule a little longer. *Sternites* mostly smooth, the fourth and fifth granular at the sides; the fifth marked with four granular keels, the lateral of which almost attain the posterior margin. *Tail* moderately strong and long, the first, second, and third segments furnished with ten strong, granular keels, the fourth with eight keels and merely vestiges in front of the accessory keel, all the intercarinal spaces more or less granular; the posterior granule of the four upper keels on the first three segments and of the two superior keels on the fourth segment a little larger than the rest; the fifth segment with its intercarinal spaces coarsely and subserially granular, smooth and depressed in the middle line above. *Vesicle* of average form, distinctly granularly carinate beneath, the *Aculeus* elongate and curved. *Pedipalpi*: Humerus and Brachium with their keels strongly developed, granular, the intercarinal spaces finely granular; hand narrower than the brachium, above bearing distinctly granular keels; fingers long, slender and curved, in contact throughout their length. *Legs* granular and carinate; the posterior two pairs with small tibial spur. *Pectines* short, with 11-12 teeth. *Dimensions*: total length 16, tail 9, trunk 7, carapace 2.5, length of hand and fingers 3, length of fingers 2.

Distribution: Baudin Island, Shark Bay, W.A.

Remarks: Pocock says, "I cannot refer this specimen to any known species of *Isometrus*. Perhaps it is most nearly related to *I. variatus* of Thorell; but it appears to me to differ from this

last-named in its granularly carinate hands, its more distinctly carinate cephalothorax, and in the presence of a tubercle which marks the position of the lateral tergal keels, etc.''

The only known specimen is Pocock's type in the collection of the British Museum. This description has been prepared from Pocock's original paper which has been rather closely followed. The *Type* is in the British Museum.

Lychas jonesae n. sp.

Colour: General colour of the trunk dark umber, a few yellowish markings on the carapace, tergites almost uniform with traces of paler > < shaped markings and two pale ocelli anteriorly, first three caudal segments ochraceous tawny, the brown markings on the keels encroaching upon the intercarinal spaces, fourth segment darker with a pale yellow distal terminal band, fifth segment umber with a pale yellow distal terminal band; vesicle umber, its base and the sulci pale yellow with a few small pale ocelli laterally; aculeus orange at the base, darker towards the tip. Under surface uniform buff yellow. Pedipalpi with coxae and trochanter honey yellow slightly marked with darker, distal joints heavily marked and dusted with brown, hand rather lighter than the brachium, fingers basally slightly darker than the hand, honey yellow at the tip; legs honey yellow, the femur distally and the patella proximally heavily pigmented with brown, tarsal joints buff yellow.

Carapace dull, closely granular, median sulcus granular, smooth when crossing the ocular tubercle, central and posterior median keels granular and distinct, superciliary crest coarsely granular continued forward for a considerable distance subsiding into an irregular group of granules on the frontal lobes. *Tergites* dull, closely granular, the granules becoming larger posteriorly on each segment; first tergite with median keel obsolete, the next five tergites with median keel stronger and distinct indications posteriorly of lateral keels in the form of a row of several enlarged granules. Last tergite with five granular keels, the median weak, abbreviated behind, the lateral keels evenly granular, terminal granule not enlarged, the inner pair almost reaching the anterior border, the outer pair shorter. *Sternites*: first four smooth and shining, fifth dull, finely granular laterally, with four subdenticulate keels, the outer pair very short, the inner pair extending about two-thirds along the sternite. *Tail* short, the trunk being as long as the first five segments, first two segments with ten granular keels, third and fourth with eight keels, the accessory keel hardly indicated on the third, quite absent on the fourth; keels granular, the superior keels with enlarged terminal granule, terminal granule of supero-lateral keel of first three segments somewhat enlarged,

intercarinal spaces dull, granular, the granules very fine below. Fifth segment with five granular keels, the granules larger on the infero-lateral and inferior keels, intercarinal spaces dull, with larger and smaller granules, superior surface convex, sulcus weak, granulation fine and close. *Vesicle* smooth and shining, inflated below, keels without granulation, surface with numerous punctures. *Aculeus* long, about three fourths the length of the vesicle, curved; tooth under the aculeus long, conical with a minute, subterminal dorsal tubercle. *Pedipalpi* normal, the Humerus keeled and granular, Brachium with three granular keels above and an arched crest anteriorly with strong distally directed teeth. Hand rounded, the finger keel represented by a row of small granules, otherwise smooth or with extremely fine granules; fixed finger with smooth keel above; movable finger with one enlarged external lateral tooth to the basal series. *Legs* granularly carinate, the intercarinal spaces dull and granular. *Pectines* with 20-21 teeth. *Dimensions*: total length 27.5, carapace 3, trunk 12, tail 15.5.

Distribution: Western Australia, interior, Hampton Hill Station, Bulong, near Kalgoorlie. The *Type* is in the Western Australian Museum, Perth (1924-446), collected by Miss F. Jones.

Lychas (Hemilychas) alexandrinus S. Hirst, 1911.

Lychas (Hemilychas) alexandrinus. S. Hirst, 1911, A.M.N.H. (8) VIII, p. 464.

Male (Description from Hirst's paper).

Colour: Fawn, except for the vesicle which is rather deep brown and much darker than the rest of the body; fingers of hand pale yellow, the hand itself being fawn coloured.

Carapace: granular throughout, superciliary crests granular, for some distance they are continued forwards and then lose themselves in irregular groups of rather large granules, and close to the anterior margin on either side some of these are arranged in a short keel-like series. Median keels comparatively well developed, especially in the posterior median pairs which are quite well marked and strong. *Tergites* granular, their lateral keels very short, even in the hinder segments, and in most of the segments they are represented by one or two enlarged granules only. Anterior *Sternites* smooth and shining, and, at most, with fine granulation at the extreme margin only. Penultimate sternite granular at the sides, but the granulation very fine except at the margin. Last sternite granular throughout and with four granular keels. *Tail* increasing in size posteriorly, last segment slightly swollen. Upper surface of segments 1-4 granular; fifth segment with the upper surface almost smooth anteriorly but the shallow excavated area in which the median groove of this segment loses itself pos-

teriorly is finely granular. Intercarinal spaces of segments 1-3 distinctly granular, the granules of those of the fourth have run together so as to form a confused network of low smooth ridges, and this causes the segment to appear a little smoother than the preceding ones, but not nearly so smooth as the fifth; the granules between the inferior median keels of the fourth are not fused to the same extent as those of the other intercarinal spaces of this segment. Caudal segments 1-3 each with ten distinct keels, those of the first and second and the upper ones of the third being distinctly granular. Terminal granule of the two upper keels of the first two segments slightly enlarged. Inferior lateral and ventral keels of the third segment smooth. With the exception of the superior, all the keels of the fourth segment are smooth, and they are weaker than those of the preceding segments; the keels of the two upper pairs are equally weak and have almost disappeared; the median lateral is still visible in the anterior two thirds of the segment, but is exceedingly weak. Fifth caudal segment smooth, shining and without any trace of keels, but furnished with large punctures. *Vesicle* smooth, shining, and with scattered punctures, the tooth under the *Aculeus* large and blunt. *Pedipalpi*: Hand furnished with granules which are distributed in an irregular manner, it has two well-marked finger keels, the part of them which is situated on the hand itself being granular, but the part on the finger smooth, an outer keel is also present on the dorsal surface of the hand, but it does not reach the apical end. Movable finger more than twice as long as the hand-back and with six median series of granules. *Pectines* with 20-21 teeth. *Dimensions*: total length 31, carapace 3.75, first caudal segment 2, fifth segment 3.75, width of first segment 2.5, of fifth segment 2.8.

Distribution: The only known specimen was collected at Alexandria in the Northern Territory. The *Type* is in the collection of the British Museum.

Genus **Isometroides** Keyserling, 1885.

Isometrus (part) Karsch., 1880, Sitzungsber. Ges. Naturf. Freunde, Berlin, p. 56.

Isometroides. Keyserling, 1885, Arach. Austr. II, p. 16.

Isometroides. Kraepelin, 1899. Das Tierreich, Lief 8, p. 40.

Isometroides. Kraepelin, 1916, Ark. Zool. K. Svensk. Vetensk. Akad. X, No. 2, p. 20.

One tooth on the lower edge of the immovable finger of the chelicerae. Tibial spur on the third and fourth legs. Carapace with anterior and posterior median keels, front horizontal.

Tergites with median keel, the last with five keels. Sternum triangular, hardly longer than broad. Sternites smooth, the last more or less granular, with four keels. First three caudal segments with inferior keels, fourth variable, fifth keelless with numerous punctures. Vesicle long, almost comma-shaped, not much narrower than the fifth segment, passing gradually into the aculeus. No tooth under the aculeus. Fingers of the pedipalpi with a long basal row of teeth, followed by five oblique overlapping series each of which is flanked externally and basally by two strong lateral teeth.

Specimens of this genus are very rare in collections; there are two specimens in the British Museum; the Zoological Museum in Berlin possesses the type of *I. vescus*, and the Zoological Museum in Stockholm has a specimen of *I. angusticaudus*, the type of which, formerly in the Museum Godeffroy of Hamburg, has now disappeared. I have seen ten specimens of *I. vescus* and two of *I. angusticaudus*.

Key to the species.

- A. Fourth caudal segment with 8 well developed keels and short accessory keels, intercarinal surfaces granular. Surface of the fifth segment punctured, rugulose. Aculeus shorter than the vesicle. Pectines with 21-23 teeth *I. angusticaudus*. Keys.
- B. Fourth caudal segment keelless or very feebly keeled, intercarinal surfaces smooth. Surface of fifth segment punctured, smooth and shining. Aculeus as long as the vesicle. Pectines with 23-26 teeth *I. vescus* (Karsch.)

Isometroides vescus (Karsch) 1880.

Isometrus vescus. Karsch, 1880, Sitzungsber. Ges. Naturf. Freunde Berlin, p. 56.

Isometroides vescus. Keyserling, 1885, Arachn. Austr. II, p. 17, pl. II, figs. 3, 3a.

Isometroides vescus. Kraepelin, 1899. Das Tierreich, Lief 8, p. 40.

Isometroides vescus. S. Hirst, 1907, A.M.N.H. (7) XIX, p. 209.

Colour: From yellow to yellowish-brown, limbs, under surface and anterior caudal segments paler, fourth caudal segment brownish, fifth dark brown or piceous, vesicle brownish. Carapace with keels, ocular tubercle and lateral ocular areas dark brown or blackish; tergites with the median keel outlined in darker and with two or three more or less distinct sub-rectangular blackish marks on each side of the median keel at the posterior margin of each segment, on these darker areas the granules appear to be of larger size. The limbs bear indistinct darker markings; there are always

two, sometimes three, brown spots on the hand near the insertion of the movable finger. The paler segments of the tail have some of their keels pigmented, a more or less persistent dark line extends along the sulcus formed by the duplicated ventral keel.

Carapace uniformly coarsely and closely granular, the median keels moderately developed, granular, superciliary ridge more coarsely granular. *Tergites* dull, coarsely and closely granular, the median keels subdenticulate, the teeth directed backwards; on the anterior segments the keels are developed only on the posterior half of each tergite, on the posterior segments they reach the anterior margin; the last tergite with five granular keels. *Sternites* rugulose and shining, the last dull, coarsely granular with two well developed granular median keels and indications of an outer pair. An indistinct pair of short sub-granular median keels may be developed on the penultimate sternite. *Tail*, the first three segments with ten granular keels, the accessory keel less prominent on the third segment; intercarinal spaces dull, granular on the first, sub-granular on the second, rugulose on the third, except dorsally where the surfaces are distinctly granular. Fourth segment shining, punctured, keels weak, indistinct or absent, the granules not distinct but coalescing to form roughly linear ridges or irregular masses. Fifth segment keelless, smooth and shining with very numerous large punctures. *Vesicle* keelless, smooth and shining with the punctures roughly aligned. *Aculeus* curved, about as long as the vesicle. *Pedipalpi*: Humerus with three finely granular keels, Brachium with three granular keels above and a prominently arched crest; anteriorly the joints are dull, granular above; lower surfaces smooth, or with a few minute granules. Hand long and slender, narrower than the brachium, keelless, the fingers very long, quite twice the length of the hand, not gaping, with a long basal and five short, oblique, overlapping apical rows of teeth, lateral teeth much larger than the central row. *Legs* dull, and granular, the tibia and the tarsal joints dull but smooth and paler in colour, tibial spur well developed, on one specimen (1924-544) it is absent from the fourth leg on the left side. *Pectines* with 23-26 teeth, (24-1033) from Merredin has 23-23 teeth. *Dimensions*: (1924-544) total length 45.5, carapace 5, trunk 16.5, tail 29. Fifth caudal segment 6.5, width of same 3.

Distribution: The more arid parts of Australia; the type was obtained "in Australia," a specimen in the British Museum was collected at Kalgoorlie. There are specimens in the Western Australian Museum from Bulong (1), Southern Cross (2), Baandee (1), Kununoppin (1), Merredin (1), Tammin (1), and White Peaks near Geraldton (1). The specimen from White Peaks has the trunk brownish but differs in no other way from the specimens from Southern Cross and Tammin. A specimen has also been re-

ceived from Dudinin on the Narrogin-Narembeen Railway, another from Serpentine, on the Darling Range, near Perth.

Isometroides angusticaudus Keys., 1885.

Isometroides angusticaudus. Keyserling 1885. Arachn. Aust. II, p. 19, pl. II, figs. 4, 4a, 4b, 4c.

Isometroides angusticaudus. Kraepelin 1899. Das Tierreich, Lief 8, p. 40.

Isometroides angusticaudus. S. Hirst 1907, A.M.N.H. (7), XIX, p. 209.

Isometroides angusticaudus. Kraepelin 1916. Ark. Zool. K. Svensk. Vetensk. Ak. X, No. 2, p. 21, fig. 1.

This species is very close to the preceding. It can, however, be distinguished by the distal caudal segments; the fourth has eight well developed keels and granular inter-carinal surfaces, the fifth is punctured and rugulose, not smooth, and the post-anal segment has the aculeus appreciably shorter than the vesicle. The Pectines have 21-23 teeth against 23-26 in *I. vesus*. *Dimensions*: The specimen in the British Museum, which is larger than the two specimens before me, has a total length of 41; length of tail (vesicle excluded) 23; length of fifth segment 6.5, width of fifth segment 3.5.

Distribution: Keyserling's type was from Peake Downs, Queensland; the British Museum possesses a single specimen from Port Lincoln, South Australia; a female from the Kimberley district, Western Australia, is in the Zoological Museum, Stockholm; the Australian Museum has a single specimen from the Pinnacles near Broken Hill, N.S.W., and the Western Australian Museum has a young individual from Warriedar Station near Lake Monger, W.A.

Sub-family **Centrurinae**.

Centrurinae. K. Kraepelin 1899. Das Tierreich, Lief 8, p. 64.

No tibial spur on the third and fourth legs. Immobile finger of the chelicerae, below, with one tooth. Tooth present under the aculeus.

This sub-family is represented in Australia by one genus, *isometrus*, confined to Queensland and tropical Western Australia.

Genus **Isometrus**. Hempr. and Ehrenb. 1828.

Isometrus. Hemprich and Ehrenberg 1828. Symbolae physicae seu Icones . . . Scorpiones.

Isometrus. K. Kraepelin 1899. Das Tierreich, Lief. 8, p. 64 (and synonymy).

Fingers of the hands with five or six inclined, non-overlapping rows of teeth, each row basally with an external and an internal lateral tooth. Tergites with a single keel. The last with five keels. Tooth under the aculeus large.

Two species are recorded, the endemic *I. melanodactylus* and the cosmopolitan *I. maculatus*.

Key to the Australian species.

- A. Pectines with 16-19 teeth (rarely 15). Tooth under the aculeus sharp and conical, the distance between its base and the aculeus greater than the diameter of the former. Superior keels of the caudal segments without enlarged terminal teeth. Distal segments of the tail not, or but little, darker than the trunk *I. maculatus* (Geer)
- B. Pectines with 10-13 teeth (rarely 14). Tooth under the aculeus laterally compressed, the distance between its base and the aculeus less than the diameter of the former. Superior keels of the caudal segments, particularly the second and third, with enlarged terminal tooth. Distal segments of the tail darker than the body *I. melanodactylus* (Koch)

Isometrus melanodactylus (L. Koch) 1867.

Lychas melanodactylus. L. Koch 1867. Verh. K. K. Zool. bot. ges. Vienna, XVII, p. 239.

Isometrus melanophysa. Keyserling 1885. Arach. Aust. II, p. 3, pl. I, ngs. 1, 1a-1e, 2, 2a.

Isometrus melanodactylus. K. Kraepelin 1899. Das Tierreich, Lief 8, p. 68, fig. 27 (and synonymy).

Isometrus melanodactylus. K. Kraepelin 1916, Ark. Zool. K. Svensk. Vetensk. Ak. X, No. 2, p. 33.

Colour: Trunk yellowish, often with darker markings and spots, interocular triangle paler; limbs paler, the brachium darker than the humerus, hands yellowish, the fingers often blackish at the base, becoming paler towards the tip, at times scarcely darker than the hand; proximal segments of the tail yellowish, fourth and fifth darker, brownish or blackish, vesicle reddish, aculeus darker towards the point. Under surface of the trunk uniform yellowish, the proximal caudal segments with or without darker markings.

Carapace granular, keelless, median sulcus moderately developed, persisting when crossing the ocular tubercle. *Tergites* granular with granular median keel, the paler areas smooth; last tergite with a granular median keel and two pairs of granular lateral keels. *Sternites* smooth and shining, the last with two granular keels. *Tail*, caudal segments keeled, the superior keels of the second and third segments with enlarged terminal teeth, in the male very much enlarged and erect, pointed, in the female less prominent and with the point directed backwards; intercarinal spaces dull, finely granular. In the male the tail is often twice the length of the trunk, in the female but slightly longer than the trunk. *Vesicle* not narrower than the fifth segment, not inflated, *Aculeus* from one third to one half the length of the vesicle, tooth laterally compressed, short and broad, truncate, with a small dorsal tubercle. *Hands* keelless, somewhat inflated, not much if at all wider than the brachium; fingers slightly longer than the handback, with six series of teeth, the basal the longest, and six internal and seven external lateral teeth. *Pectines* with 10-13, rarely 14, teeth. *Dimensions*: Male up to 52, female up to 32; the largest male I have seen measured 49, trunk 17.5, tail 31.5.

Distribution: Eastern Queensland from Cape York Peninsula to Brisbane, also West Kimberley, Western Australia. I have seen specimens from Cairns, Endeavour River, Eidsvold and Condamine. The collection of the Macleay Museum contains several imperfect specimens from King Sound, West Kimberley in tropical Western Australia, which are very near to this species, on them the darker markings are very faint or absent and the fingers are scarcely darker than the hand. They have a stouter tail, more inflated vesicle, and distinctly stouter hands. For this Western Australian form of the species the name var. *inflatus* is proposed.

***Isometrus maculatus* (Geer) 1778.**

Scorpio maculatus. Geer 1778. Mem. Hist. des Insectes, VII, p. 346, pl. 41, figs. 9, 10.

Isometrus maculatus. Keyserling 1885. Arach. Aust. II, p. 6, pl. I, fig. 3.

Isometrus maculatus. K. Kraepelin 1899. Das Tierreich, Lief 8, p. 66, fig. 26 (and synonymy).

Isometrus maculatus. K. Kraepelin 1916. Ark. Zool. K. Svensk. Vetensk. Ak. X, No. 2, p. 34.

Colour: General colour yellowish with more or less intense

blackish markings, the interocular triangle pale yellow. Under surface uniform yellowish.

Carapace keelless, finely granular, the superciliary crest more coarsely so anteriorly. *Tergites* dull, closely granular, each segment with a submarginal row of enlarged granules posteriorly, median keels granular; the last tergite with five granular keels. *Sternites* smooth and shining, the last granular with four granular keels. *Tail* in the male long and slender, about twice the length of the trunk; in the female about as long as the trunk; all the caudal keels granular; accessory keel on the first segment persistent on the second segment absent or represented by a short row of granules. Superior keels without enlarged terminal teeth. Intercarinal spaces finely granular, the granules most plentiful above, all the surfaces slightly concave. *Vesicle* long and slender, not strongly keeled, tooth under the aculeus, pointed and conical, with a small distinct dorsal tubercle, slightly compressed. *Aculeus* less than half the length of the vesicle, very strongly curved. *Pedipalpi*: Brachium indistinctly keeled; hand long and slender in both sexes, not wider than the brachium; fingers from once and one half to almost twice the length of the hand, with six internal and six or seven external lateral teeth. *Pectines* with 16-19 teeth, rarely 15, usually 17 or 18. *Dimensions*: Male up to 70, female up to 45. The males have the pedipalpi and tail much longer than the female.

Distribution: Widely distributed in tropical and subtropical lands. Dr. E. Mjoberg obtained three specimens at Broome, North Western Australia; these appear to be the only authentic Australian record. The collection of the Macleay Museum contains two males from an unknown locality—presumably Australian.